

# NATURAL HISTORY MISCELLANEA

Published by  
**The Chicago Academy of Sciences**  
Lincoln Park---2001 N. Clark St., Chicago 14, Illinois, U.S.A.

---

No. 165

October 14, 1958

---

## LONGITUDINAL STRIPING AS A PATTERN MODIFICATION IN THE SNAKE **PITUOPHIS MELANOLEUCUS**

WILLIAM J. RIEMER\*

On rare occasions snakes of the species *Pituophis melanoleucus* Daudin (formerly *P. catenifer* *er* Blainville—see Conant, 1956) are collected that show a pattern of longitudinal stripes rather than the usual pattern of blotches. Such individuals are described by Fitch (1935) and by Fisher (1935). Klauber (1947 :62) calls attention to, but does not describe, two additional specimens he has seen. Since that time other specimens have become available : Klauber acquired a third specimen ; the Carnegie Museum received one ; and I was fortunate in being able to locate one in the collections of the University of California at Davis, and also to capture an individual showing this unusual pattern. I have examined all of these specimens, and, as a result, I shall attempt here to demonstrate that striped *Pituophis melanoleucus* occur as a regular component of a certain restricted population, but striping blended with the normal pattern occurs sporadically as an aberration over a wide geographic area.

### STRIPED PATTERN

The scutellation of all the striped *Pituophis melanoleucus catenifer* I have examined falls within the limits of normal variation for that subspecies (Klauber, 1947).

There is considerable variation in the nature and completeness of the striping. At one extreme is the individual **WR 2399 (table 1)**, which differs from the condition shown in figure 1A chiefly in having fewer

\*Florida State Museum and Department of Biology, University of Florida,  
Gainesville

imperfections in the pattern. The pattern and colors in life of WR 2399 are recorded as follows :

On the neck are six prominent, black, longitudinal stripes, one and two half scales wide. The ground color separating these stripes is straw to buff. Of the three pairs of stripes lateral, dorsolateral, and dorsal the last two are less widely separated from each other than from the lateral pair. A short distance behind the neck the black pigment of the stripes becomes sporadic in distribution and is replaced by a chocolate hue. The lateral and dorsal stripes gradually expand posteriorly so that at midbody they are each three and one-half scales wide ; the dorsolateral stripe is reduced to one and one-half scales (actually two three-quarter scales) in width. The dorsal and dorsolateral stripes are poorly separated at mid-body. All of the stripes have become grayish brown, the lateral pair being the lightest. Black pigment has been reduced to an imperfect ventral and mesial margin for the set of dorsal-dorsolateral stripes on each side. Black, as a dominant hue, reappears near the posterior part of the body where the expanded stripes again become narrow. The lateral stripes terminate abruptly at the level of the vent. The other series continue onto the tail ; the dorsolateral pair for only a short distance and as a series of disjunct black spots; the dorsal pair, as somewhat broken black stripes, extend three-fourths the length of the tail. On no part of the head, body, or tail is there any suggestion of a transverse component to the pattern except for the characteristic, dark, interorbital bar. The venter is a bright flesh color and is unmarked except that a small black zone, normally hidden, is present on the anterolateral margin of each ventral scute, and most of the scutes show a scattering of dark punctations.

At the opposite extreme of variation is the specimen reported on by Fisher (1935), now MVZ 16065 ( table 1) . It differs from the description given above in that the pattern consists of four brown stripes, a lateral pair and a dorsolateral pair (fig. 1C) . Only a weakly differentiated light vertebral scale row separates the dorsolateral pair. The stripes are nowhere black or even sharply distinguishable from the adjacent light areas. Nowhere are the dark stripes reduced in width, but appear rather uniform and broad throughout. Black appears only as a series of linearly arranged middorsal specks on the body and tail in the region of the vent. The venter is similar to that described above.

The two snakes described represent extremes in the manifestation of the striped pattern as I have observed it. In table 1 the specimens are arranged in a progressive series between the extremes. The specimen reported on by Fitch (1935), now MVZ 16329, is illustrated as figure 1A.

Fitch counts seven stripes ; I have chosen to ignore his vertebral stripe since it is not black and is limited to the keel of the vertebral scale row. Similar stripes, equally conspicuous, are present on certain other light areas of the dorsum. A juvenile, CM 33983, is similar in pattern. Those bearing the UCD and LMK numbers are approximately intermediate ( fig. 1B ) between the extremes. The UCD specimen most closely approaches the pattern of MVZ 16065, but is conspicuously different in having distinct black stripes in the neck region.

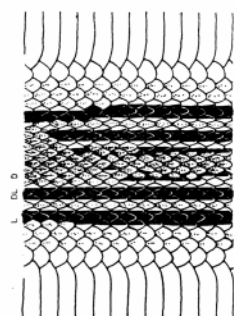
The following general statements can be made on the basis of these eight specimens. Striped *Pituophis melanoleucus catenifer* may have broad, diffuse and ill-defined stripes of poor contrast ; such stripes are brownish grey, or tan. They also may have restricted, discrete, and sharply-margined stripes ; such stripes are black or blackish brown. Even on a single individual this stripe-color relationship is expressed.

The lateral stripe is a distinct and constant element of the pattern. When present on the neck as a narrow black stripe it represents the upper margin of a broad lateral stripe, often not evident, occupying most of the first five and one-half scale rows. The first scale row is usually the color of the venter. When the dark stripe reappears on the posterior part of the body it again represents only the dorsal margin of a broad lateral stripe.

The dorsal and dorsolateral stripes appear on the neck as a single, broad, pale stripe on each side, or as two, narrow, dark stripes on each side, each pair separated by a narrow light stripe two half scales wide. Frequently this light stripe is disrupted by pigment interconnecting the two dark stripes on either side. Often the pairs of stripes are only sporadically separated, and in such instances black pigment is characteristically only present as spots or short dashes covering a few adjoining scales. Where the dorsolateral stripe is dark and discrete on the neck it represents only the dorsal margin of a broader, but not always evident, stripe. A short distance posterior, and continuing for the rest of the length of the body, the same stripe represents the ventral margin of the dorsolateral pair. In two of the snakes (LMK 31945 and 34637) the dorsal and dorsolateral stripes are indistinctly and irregularly broken into segments suggesting a slight tendency toward a transverse or blotched pattern.

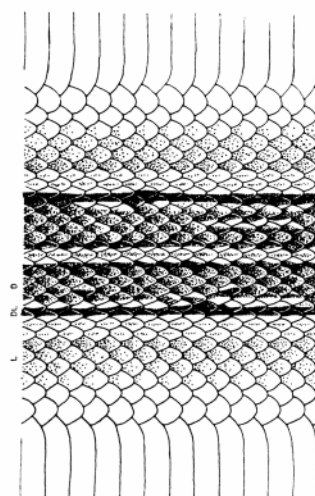
The vertebral scale row and adjacent halves are evident as a light stripe in those specimens with dark neck markings. This stripe may be obscure in those with poorly defined dark stripes. Occasionally it is continuous onto the tail. On CM 33983 the dorsal pair of stripes fuse near

NECK

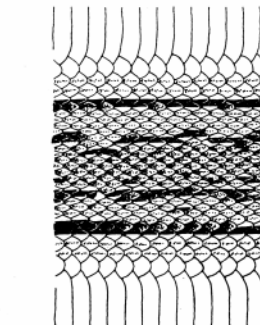
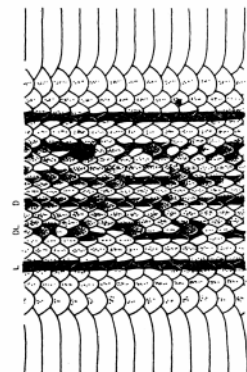


A

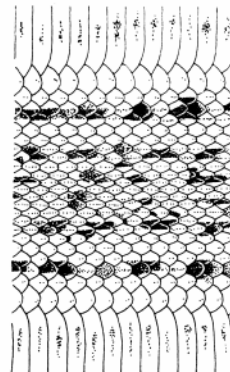
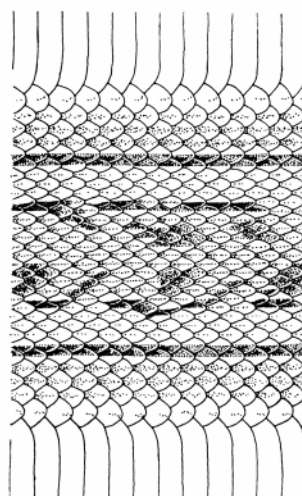
MIDBODY



ANTERIOR TO VENT



B



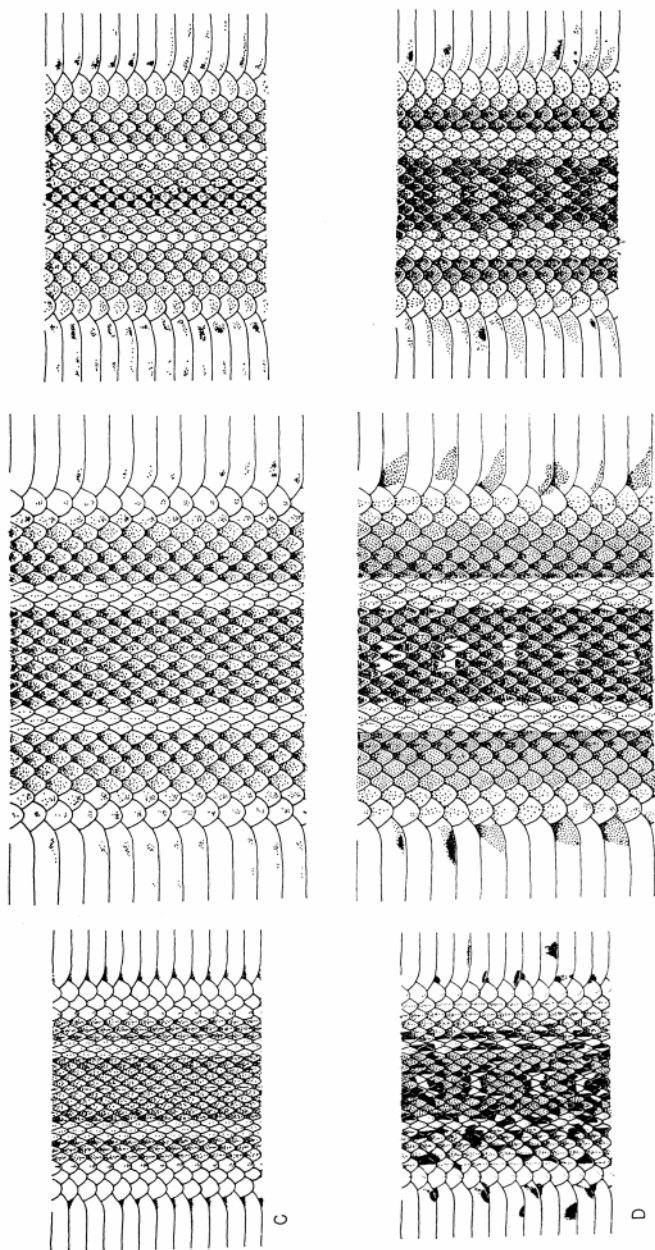


FIGURE 1. Patterns of pigmentation in *Pituophis melanoleucus*. A to C indicate the variation in the nature of striping; D shows a blend of striping and blotching. Lateral (L), dorsolateral (DL), and dorsal (D) stripes are indicated. A—MVZ 16329, B—LMK 33531, C—MVZ 16065, D—MVZ 42299.

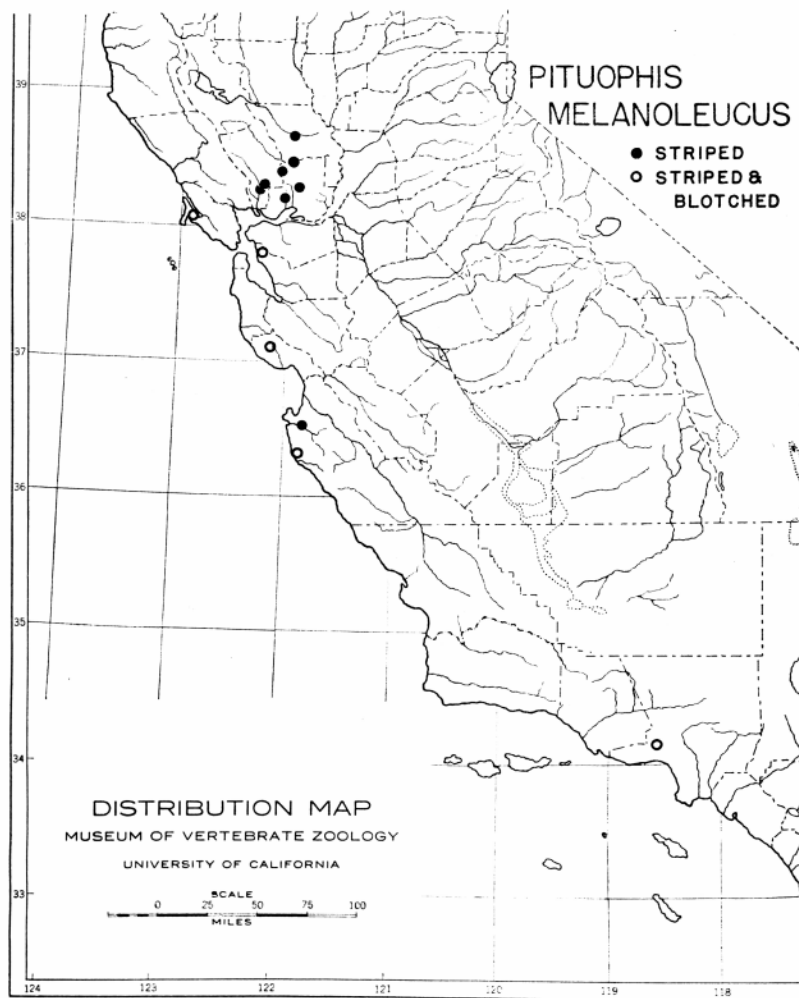


FIGURE 2. The distribution of striped *Pituophis melanoleucus*. Individuals with the usual blotched pattern occur elsewhere throughout the area of the map.

the vent to form a single dark vertebral stripe that continues onto the terminal caudal scale. All of the specimens bearing LMK numbers have no distinct pattern on the tail, but merely a scattering of dark spots.

The extreme and intermediate conditions are illustrated for the neck, midbody, and vent region of the trunk in figure 1.

It seems significant that all of the striped individuals, with the exception of one, come from a restricted area just north of San Francisco Bay (fig. 2) . Perhaps it is also significant that only the one from south of the Bay lacks dark stripes on the neck.

#### STRIPED-BLOTCHED PATTERN

During an examination of all the *Pituophis* in the Museum of Vertebrate Zoology, I came upon several individuals which showed a modification of the usual dorsal pattern suggestive of the sort of diffuse striping present in a snake (M VZ 16065) described above. In each of these snakes the usual pattern of primary and secondary blotches is present. In addition, a lateral pair and a dorsal pair of more or less well-defined, broad stripes is present. A conspicuous longitudinal zone of ground color separates these darkish stripes. A continuous light vertebral stripe, of course, is not present, although a middorsal lightening is evident. The pattern of blotches may or may not be largely obscured by the stripes depending on the intensity of the hue of the blotches. In every instance, however, a series of dark transverse bands is present on the tail. The nature of this secondary striping seems to relate it closely to the type of striping previously described. Indeed, it is probable that the striped snake, MVZ 16065, would be in this category except that it completely lacks any trace of a blotched or transverse pattern.

The striped-blotched individuals are from more widely scattered localities than the striped ones (fig. 2) . There is an apparent concentration in the San Francisco Bay area that seems to be the result of more than merely intensive collecting.

#### DISCUSSION

The situation as presented here for *Pituophis* is reminiscent of that described by Klauber (1936) for *Lampropeltis getulus*, and later discussed by Klauber (1939 and 1944) and Smith (1943) . *Lampropeltis getulus* of coastal California typically possesses irregular rings of light and dark. Frequently it is found with no trace of such a pattern, but instead a series of light and dark stripes running the length of the body and tail. In *L. getulus*, too, a restricted area—centering in this case

TABLE 1. Data for striped and striped-blotched *Pituophis melanoleucus* from California

STRIPED.—Arranged from the top downward in a progressive series from the darkest, most conspicuously striped to the lightest, least conspicuously striped.

WR*	2399	ad. ♀	Solano Co., Vaca Mts., 9 mi. NW Vacaville.
MVZ	16329	ad. ♂	Solano Co., 3 mi. SW Vacaville. (Figure 1A.)
CM	33983	juv. ♂	Solano Co., Fairfield.
UCD	3755	ad. ♂	Yolo Co., 3 mi. SW Winters, Putah Creek Canyon.
LMK	34637	juv. ♂	Napa Co., Napa.
LMK	33531	juv. ♂	Napa Co., 4½ mi. NE Napa. (Figure 1B.)
LMK	31945	juv. ♀	Yolo Co., 10 mi. W Woodland.
MVZ	16065	ad. ♂	Monterey Co., Carmel Valley. (Figure 1C.)

STRIPED-BLOTCHED.—Arranged geographically from north to south.

MVZ	40573	Marin Co., Inverness.
MVZ	11397	Alameda Co., Berkeley.
EV*	82	Santa Cruz Co., Boulder Creek (town).
MVZ	42299	Monterey Co., Little Sur River. (Figure 1D.)
MVZ	59776	Los Angeles Co., Woodland Hills.

CM stands for Carnegie Museum; EV, Eugene Volz; LMK, Laurence M. Klauber; MVZ, Museum of Vertebrate Zoology; UCD, University of California, Davis; WR, William Riemer. The present location of the specimens marked with an asterisk is not known.

around San Diego, California has produced most of the striped snakes. They are not rare, however ; they constitute 40 percent or more of the local population (Klauber, 1956 :205) .

I am aware of no other instance than the two cited in which striped individuals occur as a regular component of a freely interbreeding population of typically blotched or banded snakes. In numerous other genera and families striped patterns occur as aberrations of the normal pattern, but such individuals occur singly at unpredictable times and places. A general account of the manifestation of patterns in snakes is now in preparation.

It seems reasonable to suppose that the sudden and rather unexpected occurrence of a striped pattern phase within a species characterized by a transversely arranged pattern may be due to some relatively simple genic mechanism.



In addition, it is suggested that in *Pituophis* two separate and non-conflicting genetic mechanisms exist which produce the typical and striped patterns respectively. This possibility is suggested by the fact that a few snakes display what appears to be a blending of the typical and the striped pattern.

I am indebted to those institutions and individuals that have made specimens available, to Wayne King for preparing the drawings, and to Herndon Dowling for constructive criticism of the manuscript.

#### LITERATURE CITED

Conant, Roger

1956. A review of two rare pine snakes from the Gulf coastal plain. Amer. Mus. Novitates, no. 1781, pp. 1-31.

Fisher, Edna M.

1935. Color variation in the coast gopher snake. Copeia, 1935, no. 3, pp. 151-152.

Fitch, Henry S.

1935. An abnormal pattern in a gopher snake. Copeia, 1935, no. 3, pp. 144-146

Klauber, Laurence M.

1936. The California king snake, a case of pattern dimorphism. *Herpetologica*, vol. 1, no. 1, pp. 18-27.  
 1939. A further study of pattern dimorphism in the California king snake. Bull. Zool. Soc. San. Diego, no. 15, pp. 1-23  
 1944. The California king snake: a further discussion. Amer. Midland Nat., vol. 31, no. 1, pp. 85-87  
 1947. Classification and ranges of the gopher snakes of the genus *Pituophis* in the western United States. Bull. Zool. Soc. San Diego, no. 22, pp. 3-83.  
 1956. Rattlesnakes, vol. 1. Berkeley: Univ. California Press, 708 pp.

Smith, Hobart M.

1943. Another analysis of the status of the western king snakes of the *getulus* group. Amer. Midland Nat., vol. 29, no. 1, pp. 245-251.

*Natural History Miscellanea*, a series of miscellaneous papers more or less technical in nature, was initiated by The Chicago Academy of Sciences in 194-6 as an outlet for short, original articles in any field of natural history. It is edited by the Director of the Academy with assistance from the Scientific Governors' Committee on Publications and other qualified specialists. Individual issues, published at irregular intervals, are numbered separately and represent only one field of specialization ; e.g., botany, geology, entomology, herpetology, etc. The series is distributed to libraries and scientific organizations with which the Academy maintains exchanges. Title pages and indexes are supplied to these institutions when a sufficient number of pages to form a volume have been printed. Individual specialists with whom the Academy or the various authors maintain exchanges receive those numbers dealing with their particular fields of interest. A reserve is set aside for future exchanges and a supply of each number is available for sale at a nominal price. Authors may obtain copies for their personal use at the prevailing rates for similar reprints.

W. J. Beecher, Director